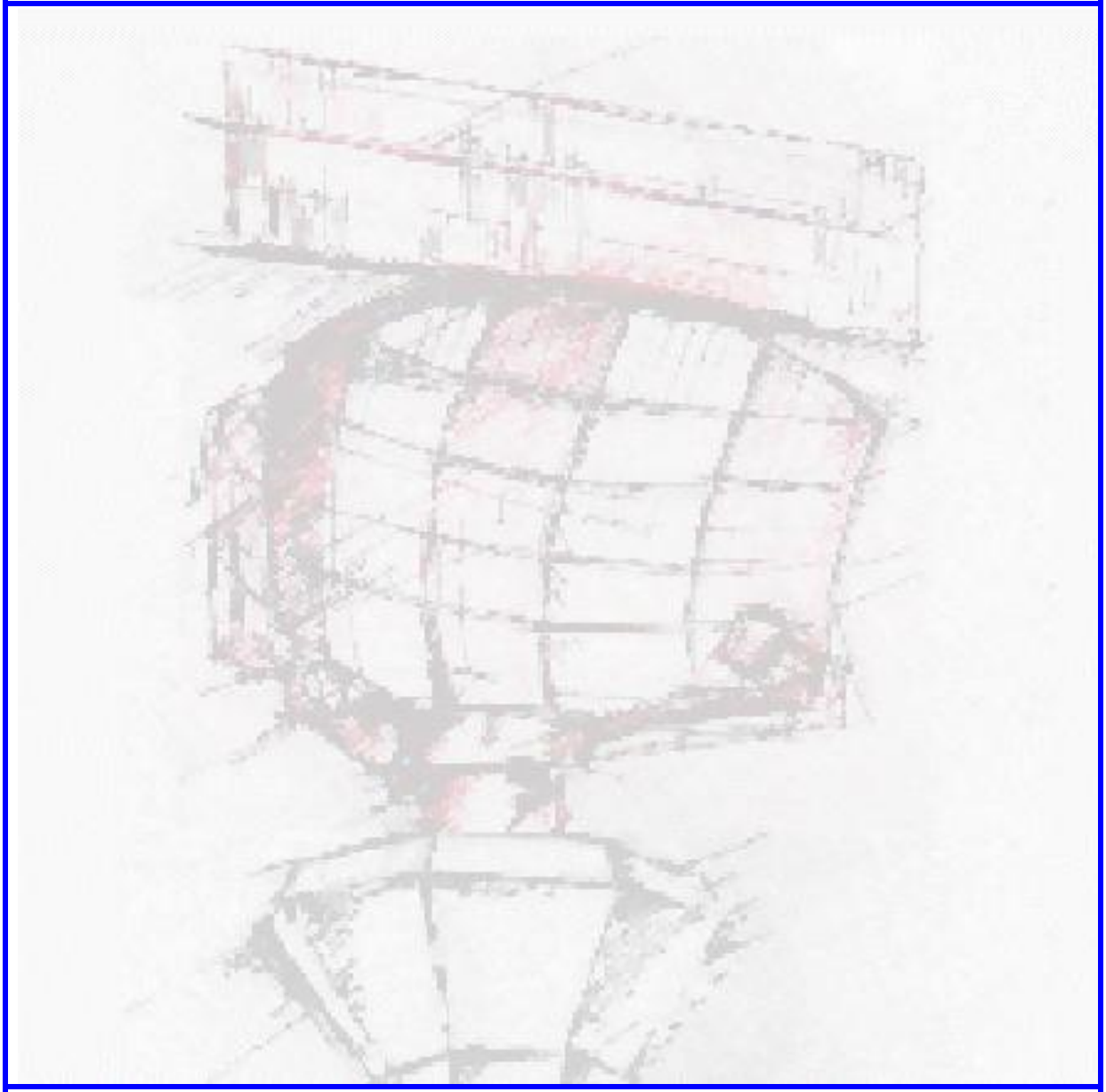
RASS-R - Data Replay



User Manual

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INTERSOFT ELECTRONICS

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Abstract

This manual describes how to use the Data Replay tool in the RASS-R toolbox. Data Replay can be used for synchronous and actual time stamped replay of radar data, from and to any type of input/output using the DHM functionality.

Keywords

Replay, Synchronous replay, Replay source, DHM, Data injection, Multi radar tracker

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1.1	24/06/08	Layout updated	All
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CONVENTIONS USED IN THIS MANUAL

The following conventions are used in this manual:

Note: This icon to the left of bold italicized text denotes a note, which alerts you to important information.

Caution: This icon to the left of bold italicized text denotes a caution, which alerts you to the possibility of data loss or a system crash.

Warning: This icon to the left of bold italicized text denotes a warning, which alerts you to the possibility of damage to you or your equipment

1. Introduction

This manual describes how to use the Data Replay tool in the RASS-R toolbox. Data Replay can be used for synchronous and actual time stamped replay of radar data, from and to any type of input/output using the DHM functionality.

Before continuing with this user manual, it is necessary to understand the operation of the DHM and to have read its user manual. **(Refer to IE-UM-00025-xxx DHM.pdf)**

In order to **inject data into an ATC system** for simulation, testing or replay purposes, you might have the need to change the Time Of Detection (TOD[1]) from the original plot data. Only in this way, a Multi Radar Tracker or MRT –like for example ARTAS from EUROCONTROL– will process the injected plots because the TOD now contains the actual UTC time again[2].
Updating the original TOD to the current UTC synchronized TOD, is performed on an .edr recording with the RASS-R **Data Replay tool** in combination with the **Data Handling Manager**. Plots and tracks are replayed in exactly the same order and time as they are recorded.
Of course, one of the main requirements is that the RASS computer system for data injection is also synchronized to UTC by means of a NTP-time server or by Intersoft Electronics' GPS450.

Data replay injection is done in two steps:

Step 1: Creation of a replay file
A data source must be converted to a replay file (extension '.rpl'), so that the position of the TOD in the file is exactly known. Only with a correct index as pointers to the TOD, the Data Replay tool can **real time** update the TOD of every single plot. This convert is performed with the module called "ReplayRecorder" in the DHM.

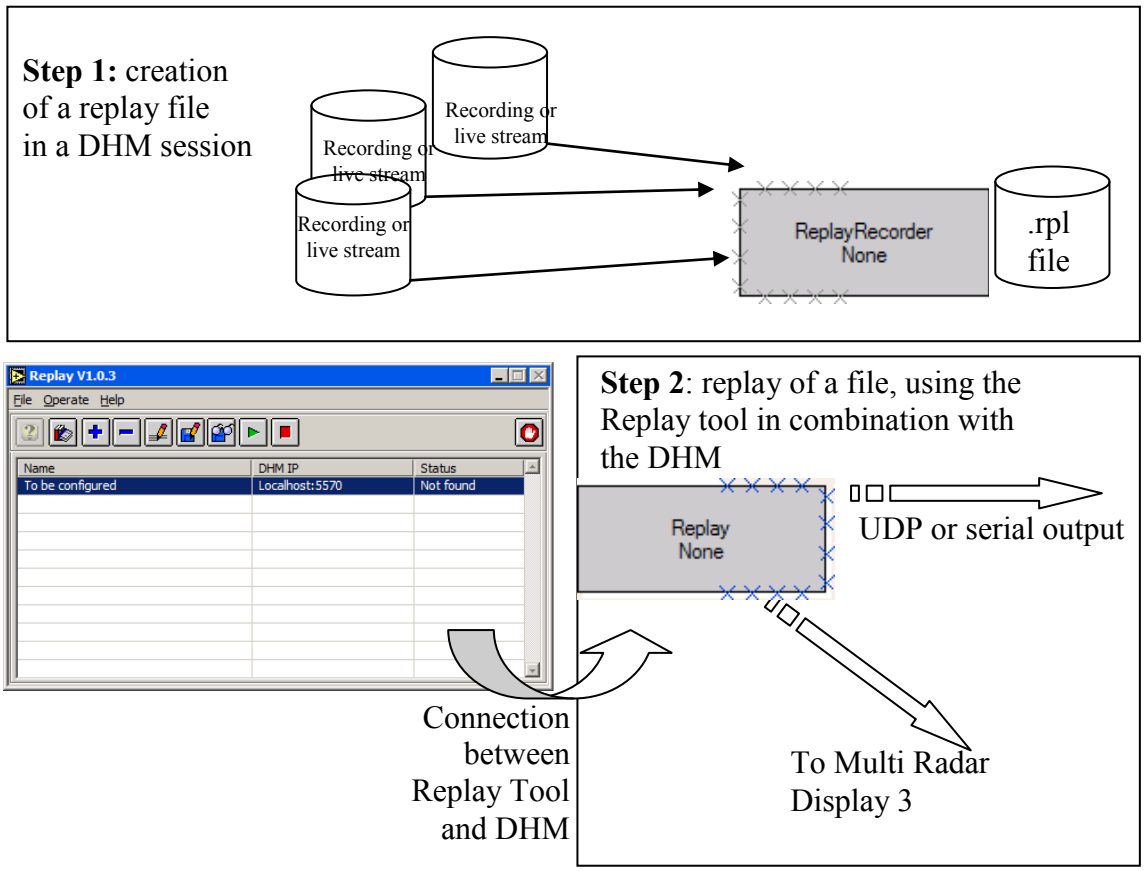
Figure 1-1: DHM ReplayRecorder and Replay module

A **data source** for the replay recorder can either be a **live data stream** or a **recorded .edr file**.
The ReplayRecorder can contain up to 12 different data streams (live or recorded), coming from different type of sensors (for example ASTERIX CAT034/048 together with ASTERIX CAT001/002)
In case data without a TOD in its message content –like for example AIRCAT500– needs to be injected as well, it can be sent to the same ReplayRecorder. This data source will be replayed synchronously with all other timestamped data sources, while maintaining the same order of all plots as they were input.

[1] TOD in ASTERIX CAT048/I140 or Truncated Time of Day in ASTERIX CAT001/I141
[2] Typically, a MRT does not use outdated plots in its multi radar tracking process

Step 2: Injection of the replay file
Finally, the injection of the .rpl-file is fully controlled by the Data Replay tool together with the “Replay” module in the DHM. The injected data has a time accuracy of ± 10msec.

Schematically, the configuration is as follows:



As one can see in the figure above (step 2), the output of the DHM “Replay”-module is again an .edr datastream, which can be sent to any of the following DHM modules:

- UDPOutput: to output over UDP
- RadarOutput: to output to a MRD3 (but convert to D6 again first)
- UDR600 (or RDR803): to output on serial interface
- EDRrecorder: to record the data again as .edr data stream

For more information, refer to the user manual of the DHM. (IE-UM-00025-xxx DHM.pdf)

2. RASS-R toolbox

The RASS-R toolbox is installed on your pc and has a shortcut on the desktop. It can also be accessed using the Windows Start-menu. The toolbox is displayed in Figure 2-1: RASS-R toolbox. The current version of the RASS-R toolbox is displayed in the right upper corner. The Data Replay tool is part of this RASS-R toolbox and can be opened using the appropriate icon .

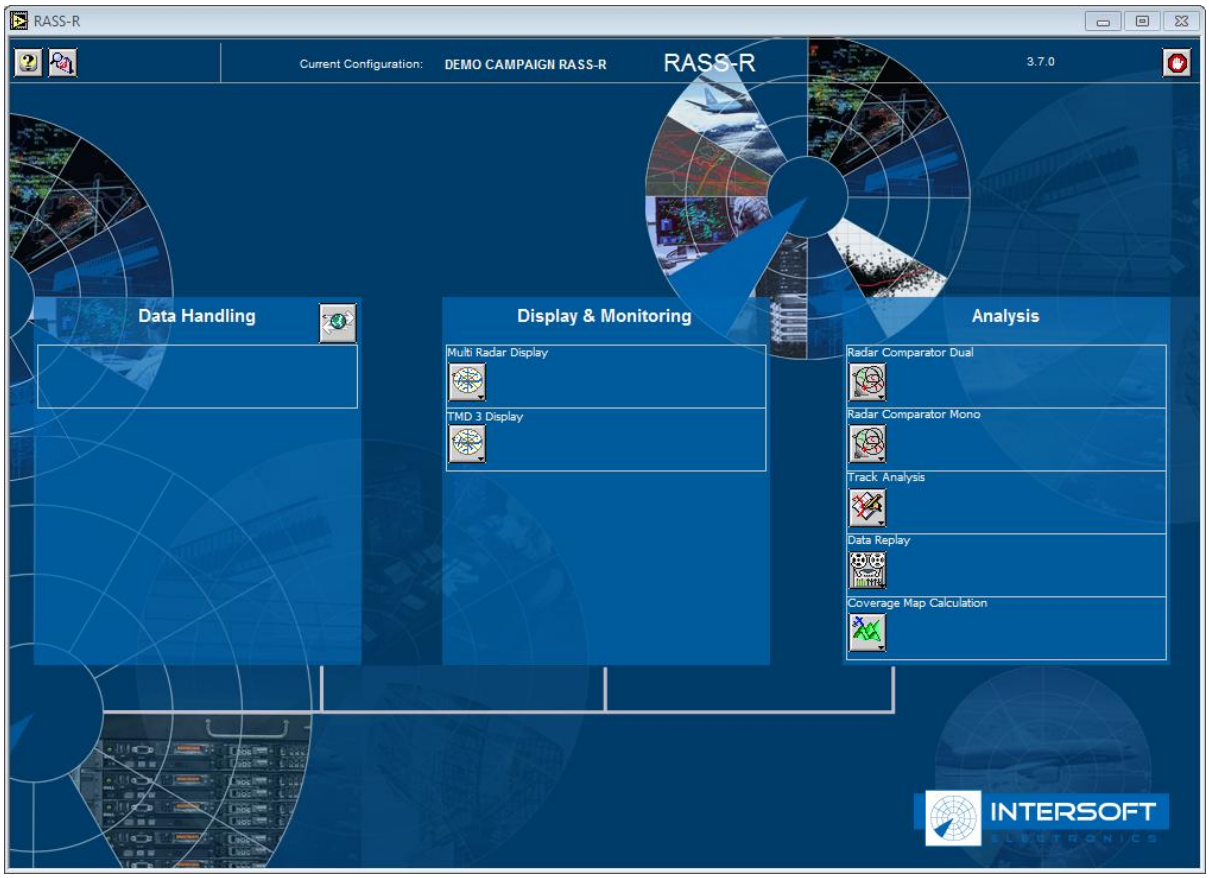


Figure 2-1: RASS-R toolbox

The menu bar contains the following items:

Table 2-1: RASS-R menu bar

Button	Usage
Help window	When this button is clicked, the Help window will appear and show help information whenever you point over a button.
Campaign change	Click this to make an appropriate campaign structure (see further)
Exit	Quit the application

Clicking the button allows the selection of the RASS-R campaign folder. Select the correct path. Upon completion, you should have the following directory structure created as in Figure 2-2: Campaign directory structure.

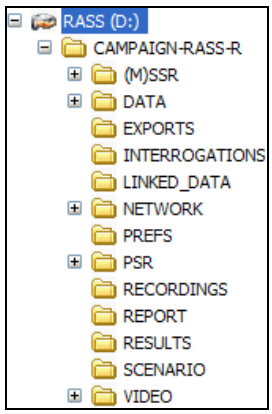


Figure 2-2: Campaign directory structure

When you make a campaign folder with the RASS-R toolbox, it is preferred to make it on a separate drive than the drive where your operation system is on. For example, as in the figure above, a structure named "CAMPAIGN-RASS-R" is created on the D-drive.

3. Software usage

3.1 User Interface

Clicking the icon in RASS-S tools' Analysis list opens the Data Replay tool and the following window will appear:

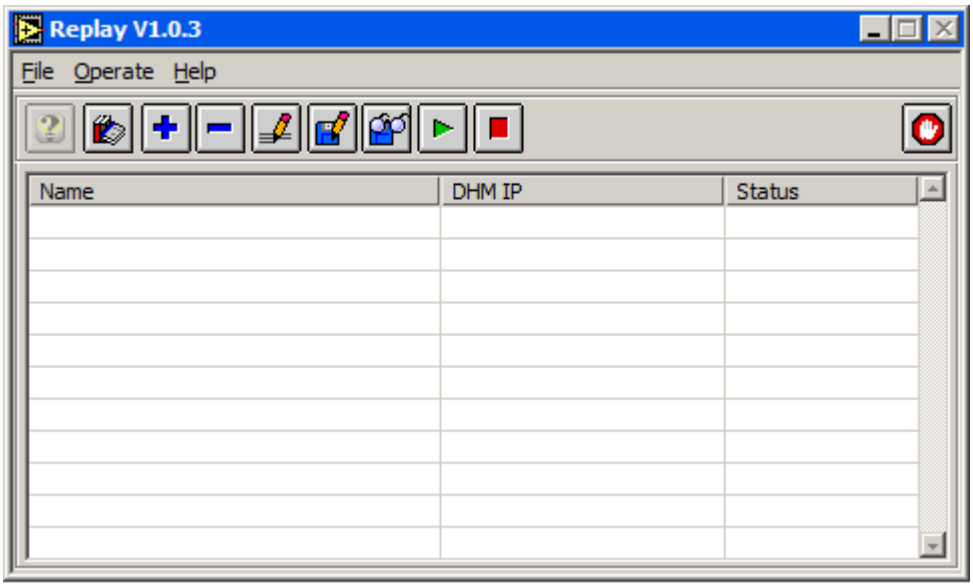


Figure 3-1: Data Replay tool

3.1.1 File menu

The menu contains the following items. Most of them are also available using the buttons (explained in the next paragraph)

Table 3-1: File menu

Menu (shortcuts bold)	**Usage**
File	Main menu to access application related functions
↳New **Ctrl+N**	Add a new replay session
↳Edit **Ctrl+E**	Edit a replay session
↳Delete **Ctrl+D**	Delete a replay session
↳Load configuration **Ctrl+L**	Load an existing configuration
↳Save configuration **Ctrl+S**	Save a configuration
↳Exit **Ctrl+Q**	To quit the application
Operate	
↳Start session	Start a replay session
↳Stop session	Stop a replay session
Help	Main help menu to access all help items
↳Online reference **Ctrl+R**	Under development
↳Turn strips on/off	Enables/disables button information
↳About **Ctrl+A**	Under development

3.1.2 Menu bar

The next table gives a brief summary of all the buttons. The usage will become clear when reading this manual.

Table 3-2: Menu bar

Button	Usage
Help window	Under development
Online Reference	This invokes the online manual. (under development)
Add	Add a replay session
Delete	Remove a replay session
Edit	Edit a configuration
Save	Save a configuration
Load	Load a configuration
Start	This starts the replay
Stop	This button stops the replay
Exit	Quit the application

3.2 Add/delete and configure a replay entry

When you click the button, an entry named "**To be configured**" will be added in the list. Multiple entries can be configured which can be replayed all simultaneously. As you can see in the image below, another entry, named "REPLAY RDR9", is present.

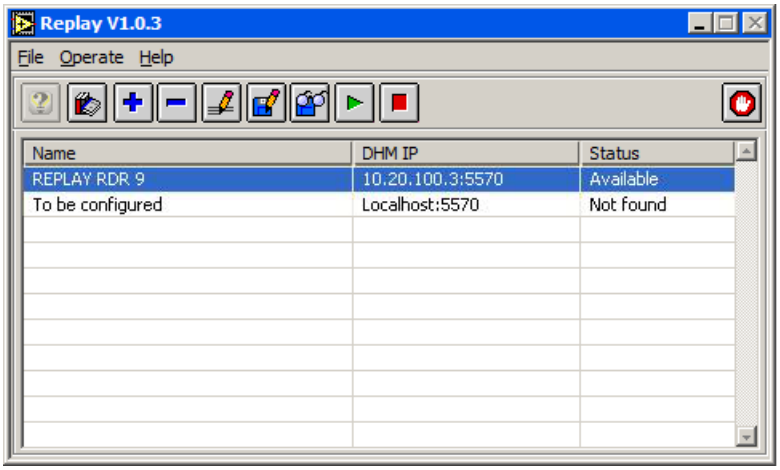


Figure 3-2: First step

For the entry that we just added, we now have **to make a connection with a DHM server** and **select an appropriate file for replay**.

Click the button and the next window will appear:

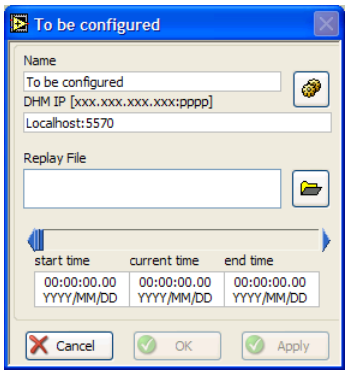


Figure 3-3: Configuration

First, the Data Replay tool must connect to a DHM background server where a replay module in a session is configured. Click and the following window will open.

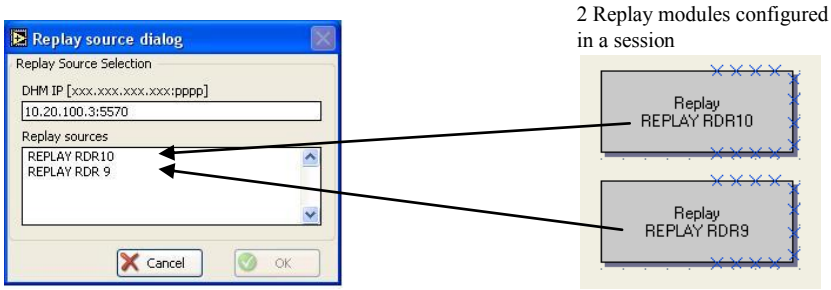


Figure 3-4: Replay source dialog

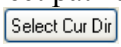
You can fill in the **IP address and port** of the DHM background. In case it is running on your local computer, it is sufficient to choose 'local host'. The window will automatically list all the available **Replay sources** running on the selected DHM.
In other words: the names displayed, "REPLAY RDR10" and "REPLAY RDR9", correspond to names set in the Replay module (see figure above) running on DHM server 10.20.100.3:5570.

Each replay entry can only correspond to one replay source!

In case you define a wrong IP address or port number, the following dialog will appear:

TMD: invalid IP
Invalid IP address and/ or port number.
Enter IP address in dot notation or type hostname folowed a colon and the port number.
DHM default port is 5570.
OK

Figure 3-5: Invalid IP address or port number

Secondly, select the correct replay file. This can be done using the button. Select the correct path and look for a file with extension *.rpl. When you are in the right folder, press the  button.

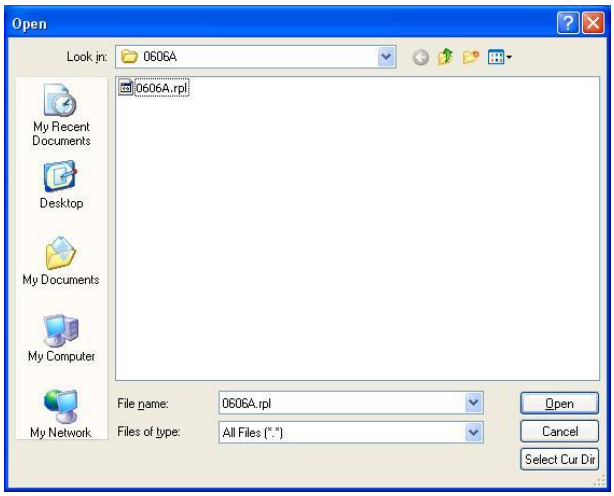


Figure 3-6: Select .rpl file

If a file is selected, the recorded start and end time will be shown as in the figure below. You can use the slider to define a time window in the file to be replayed.

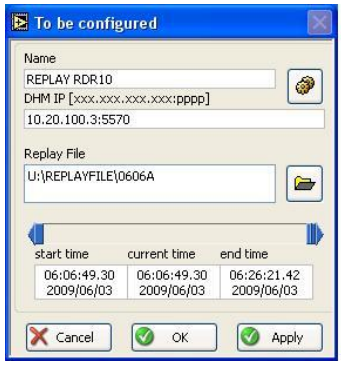


Figure 3-7: Configuration completed

If no start or end time is displayed, your file is not correctly selected, empty or corrupt.

If the configuration is setup successful, the user interface will be as follows:

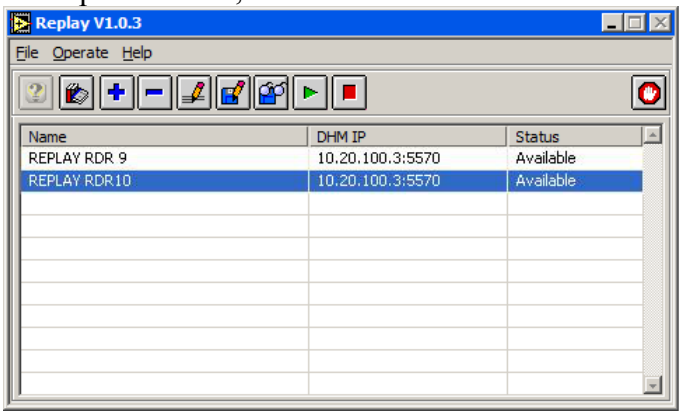


Figure 3-8: Entry completed

3.3 Load/ Save a configuration

Saving and loading a configuration is possible by simply clicking and .

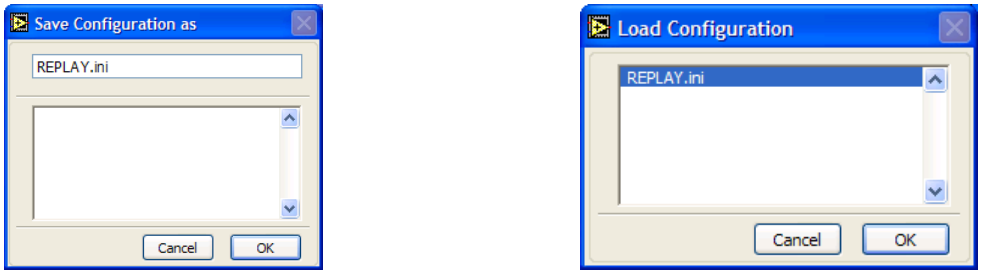


Figure 3-9: Save - Load a configuration

3.4 Play/stop a replay configuration

The last step is to run a replay entry clicking the and button.
Consequently, you will also see that the corresponding sessions in the DHM Server are running.

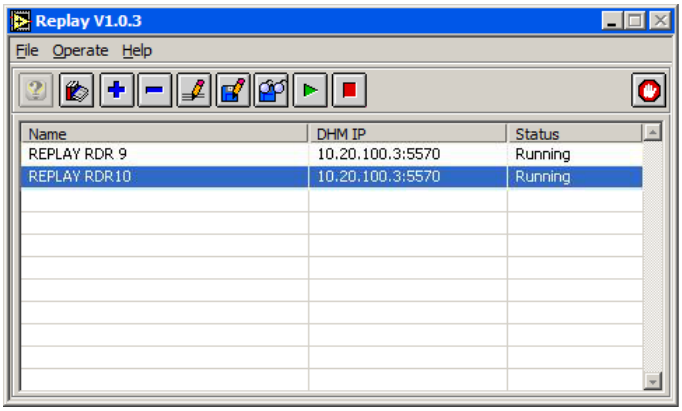


Figure 3-10: 2 Sessions running

4. Tutorial

This tutorial explains about an arbitrary .edr file, that is converted into a .rpl file, and then injected in an ATC centre by using a RDR803.

4.1 Convert .edr data into .rpl file

In the session below, you can see that the file 100714_0800.edr, used in the EDRReplay module, contains 4 ASTERIX recordings and 1 AIRCAT recording. They are all converted into one replay file, titled REPLAY CONVERT 100714_0800.rpl.

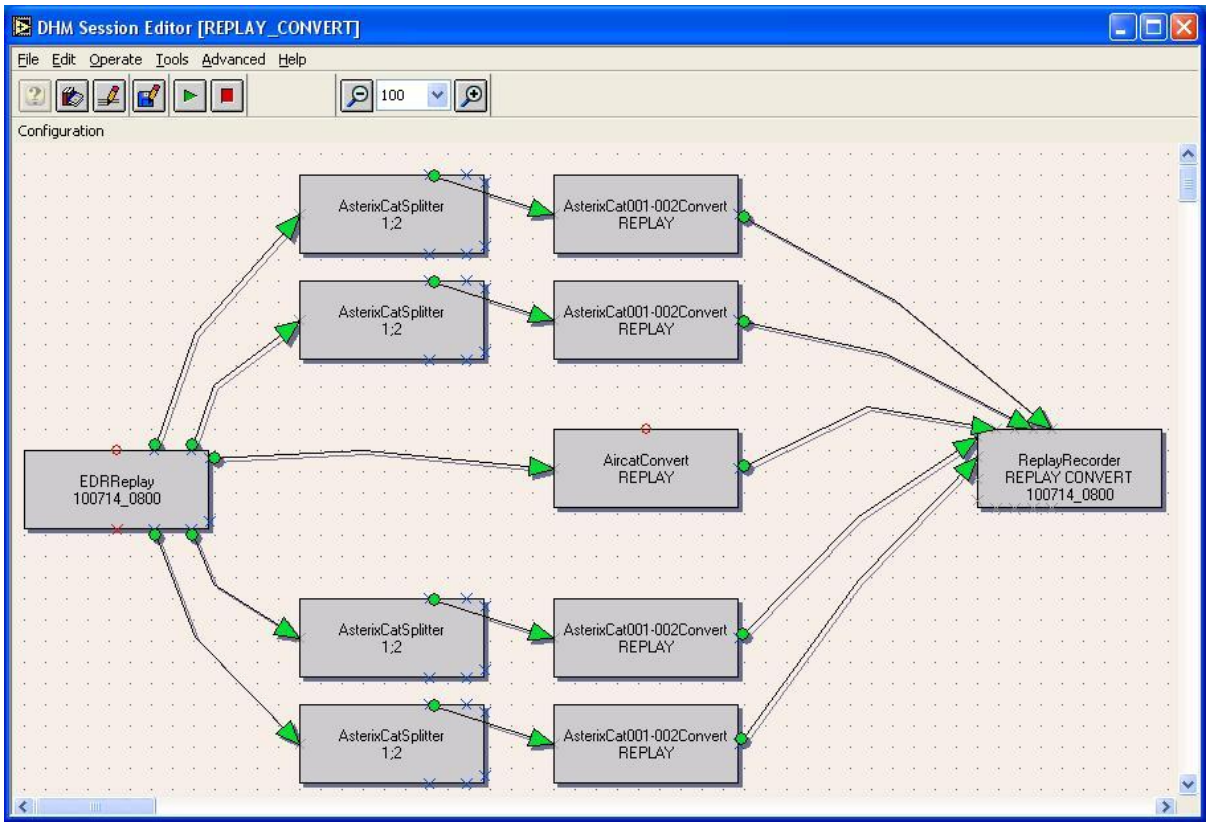
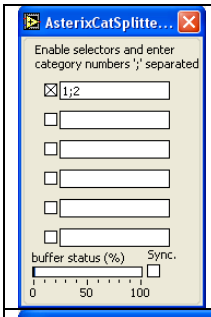
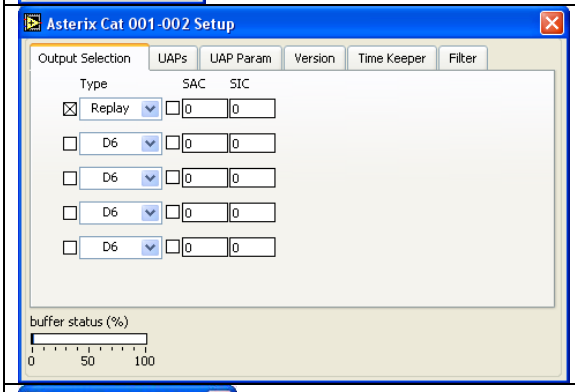
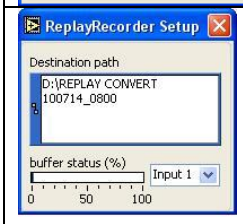


Figure 4-1: DHM session for replay file convert

The next table explains some settings in more detail:

Description	Configuration
	The .edr file that we want to convert into a .rpl file, is titled 100714_0800 and is saved on the D-drive. Because you just want to convert this file at once, you can increase its speed to for example 50. Do not set to continuous replay the .edr-file! Upon correct selection of a source path, you will see a valid start and end time.

	Use the ASTERIXCatSplitter to split multiple ASTERIX data messages in a single protocol frame. Do this for all categories present in the data stream, i.e. category 1 and 2. (This is not applicable on for example AIRCAT because AIRCAT only has one AIRCAT message in an AIRCAT frame)
	Instead of output type D6, we choose 'Replay'.
	Select a correct path as destination where the replay file will be saved. The Input1/2/3/4/5 /6 dropdown list only displays the buffer status for that particular input.

Now **start the session in the DHM Configuration Manager** and the convert process will begin.
The status of the convert can be checked any time by double clicking the EDRReplay module.

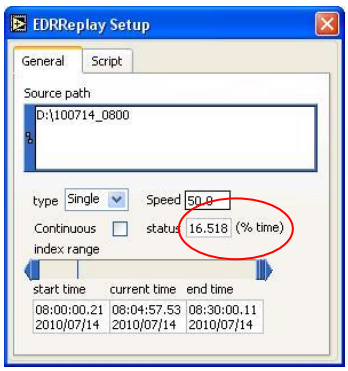


Figure 4-2: Progress 16.518% of the file

When the .edr file is replayed, the EDRReplay-module will turn yellow instead of green.

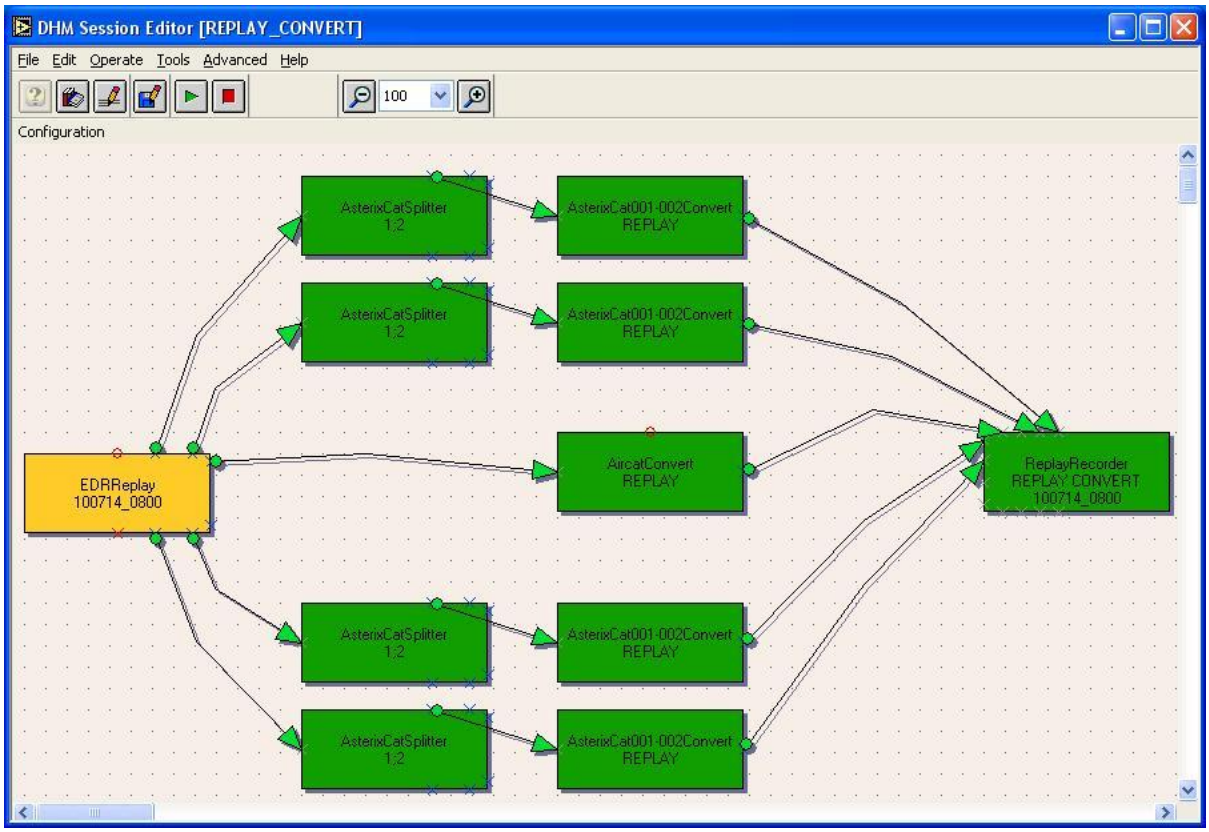


Figure 4-3: Replay convert finished

Now, stop and close the session in order to have the .rpl file finished correctly. Not performing this step will result in a corrupt .rpl file!

When the process is done, we can compare the original file and the new file in Windows Explorer as in the figure below.
The original file is an EDR-file (always together with its index file .idx), the replay file has extension .rpl now.

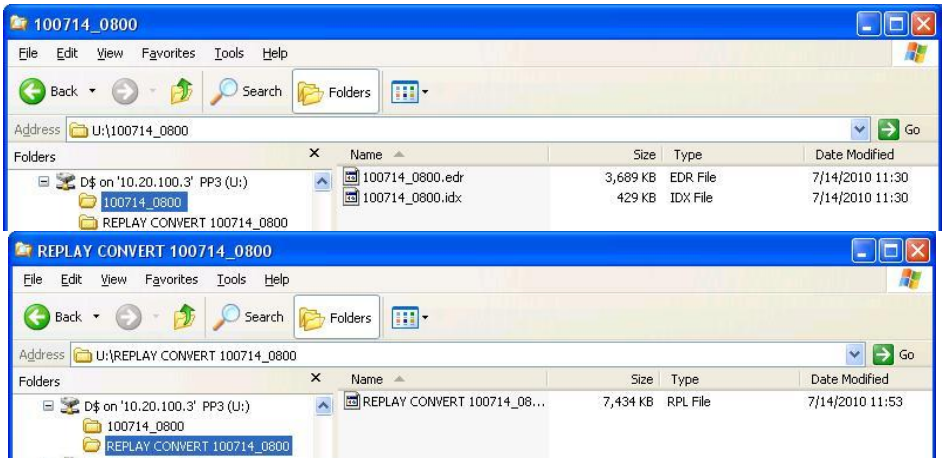


Figure 4-4: edr-file versus rpl-file

4.2 Configure a DHM session to replay the file

Because the Data Replay tool connects to a replay-module in a DHM session, we create the following DHM session named PP3_RDR_9_OUTPUT. The purpose of this session is twofold:

- Output "*injection*" of all data by means of the serial lines in a Radar Data Recorder RDR803 (with serial number 9), that contains 3 UDR2's (serial number [161][163][162])
- Secondly, we want to display the data in a MRD3 for which we configure 5 RadarOutput modules. It is clear that this step is not necessary for injection of data, but it is a good check to verify if the replayed data is correct!

Build a session as follows:

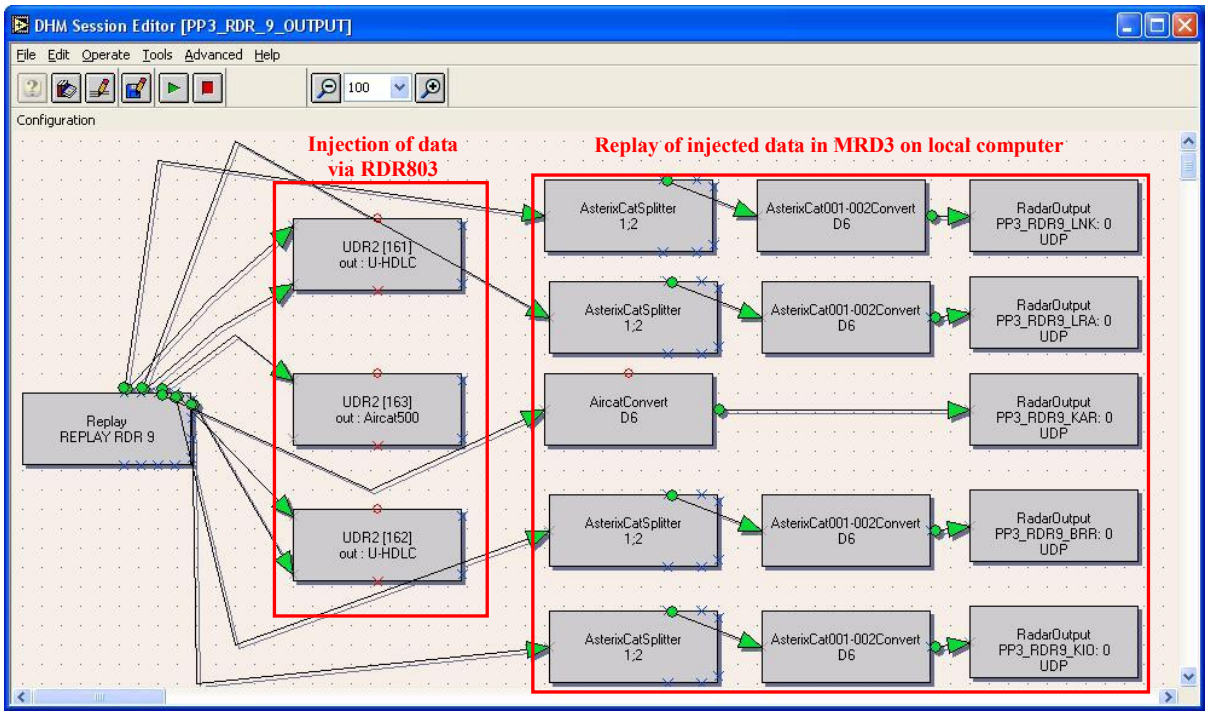
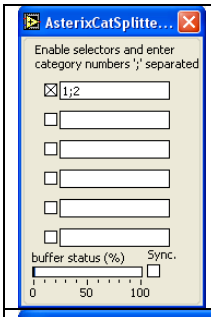
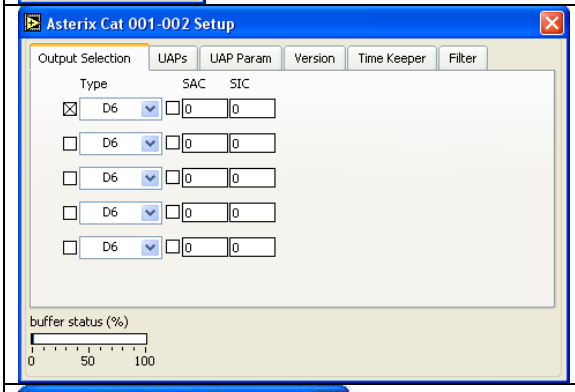
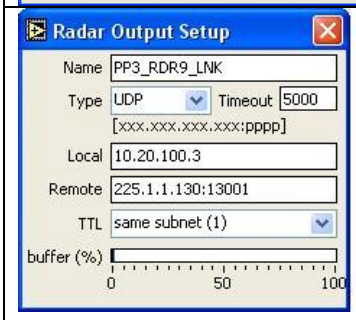

DHM Session Editor [PP3_RDR_9_OUTPUT]
File Edit Operate Tools Advanced Help
Configuration
Injection of data via RDR803
Replay of injected data in MRD3 on local computer
Replay REPLAY RDR 9
UDR2 [161] out : U-HDLC
UDR2 [163] out : Aircat500
UDR2 [162] out : U-HDLC
AsterixCatSplitter 1;2
AsterixCat001-002Convert D6
AircatConvert D6
RadarOutput PP3_RDR9_LNK: 0 UDP
RadarOutput PP3_RDR9_LRA: 0 UDP
RadarOutput PP3_RDR9_KAR: 0 UDP
RadarOutput PP3_RDR9_BRR: 0 UDP
RadarOutput PP3_RDR9_KIO: 0 UDP

Figure 4-5: DHM session for data replay

Take care of the following settings:

Description	Configuration
	This is the most important module in the DHM session. It is the Data Replay tool that connects to this module. In other words, the name given here "REPLAY RDR9" will be visible in the Data Replay tool as well. Upon selection of the "Keep original time stamp", the data will be replayed with original TOD.

	Use the ASTERIXCatSplitter to split multiple ASTERIX data messages in a single protocol frame. Do this for all categories present in the data stream, i.e. category 1 and 2. (This is not applicable on for example AIRCAT because AIRCAT only has one AIRCAT message in an AIRCAT frame)
	Instead of output type Replay, we choose now D6 as the data type to connect with the Radar Output module.
	In order to connect to a MRD3, you configure the Radar Output module as follows: “PPR3_RDR9_LNK” is the name of the data stream that will be visible as digital layer in the MRD3. The data is sent over UDP, leaving from local network card 10.20.100.3 and sent to multicast address 225.1.1.130:13001 with a TTL equal to the same subnet.

4.3 Configuration of the Data Replay tool

Click the button to have a default entry loaded:

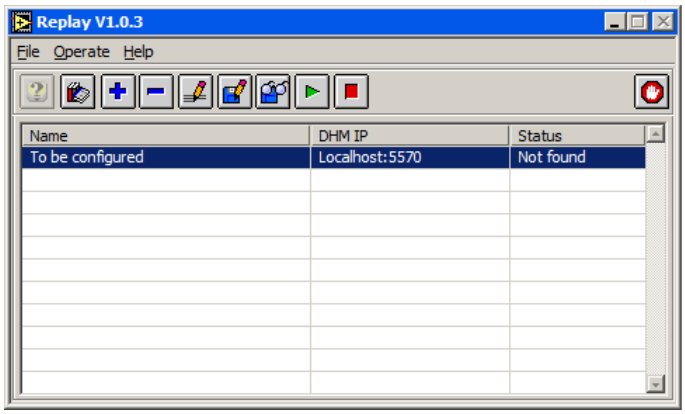


Figure 4-6: Default session loaded

Click the button to configure this entry.

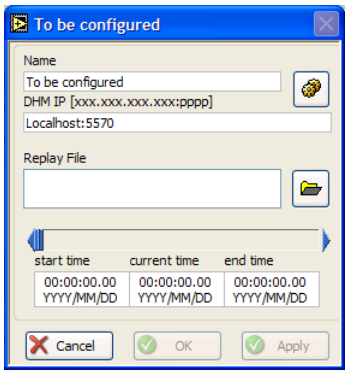


Figure 4-7: Configuration of a session

Click to select a corresponding replay source in a DHM, and select 'REPLAY RDR9'. Press OK.

Figure 4-8: Select the appropriate replay source

Now press to choose an appropriate .rpl file. Remember to select and not just the .rpl file to open. Only when you see a valid start and end time, the file is correctly loaded! (See remark at page 15.)

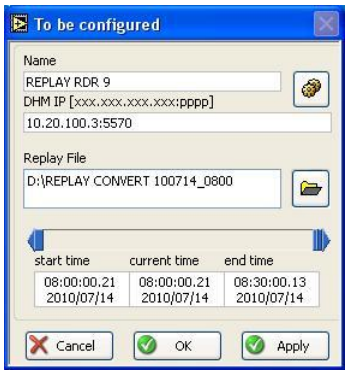


Figure 4-9: File correctly configured.

If the configuration is setup successful, the user interface will be as follows:

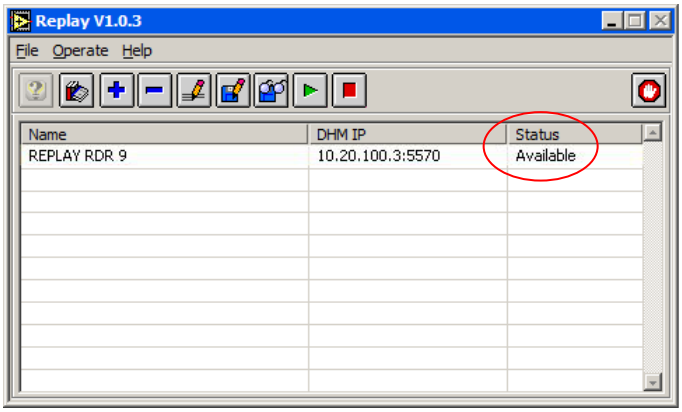


Figure 4-10: User interface with session loaded

When we start the replay by clicking in the Data Replay tool user interface, the Status will be ‘running’.

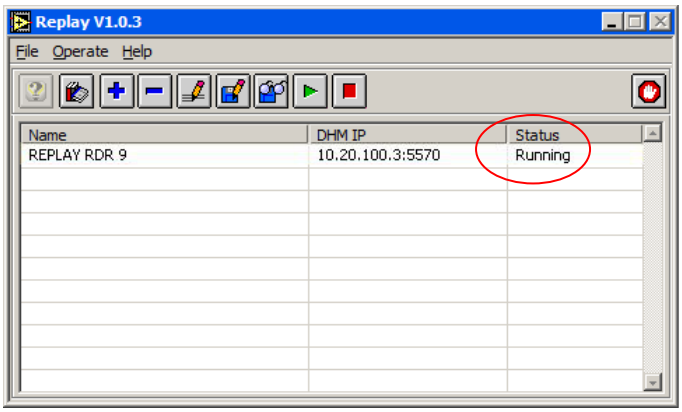


Figure 4-11: Data Replay is running

Consequently, the session in the DHM with the same replay-module name, will be started as

well.

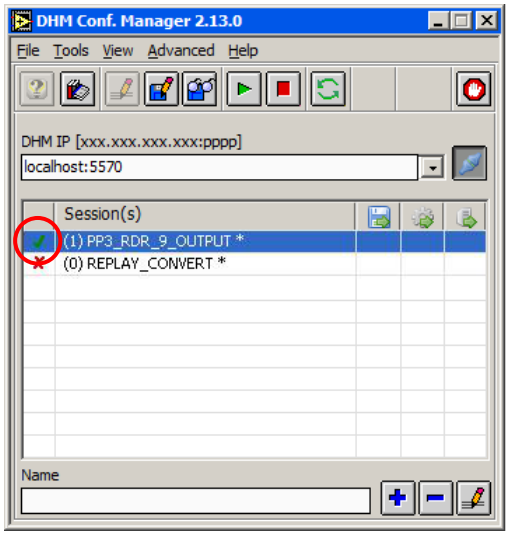


Figure 4-12: Session started in the DHM Configuration Manager

As a result, the DHM session will show green blocks that are running. Upon opening the status window of the Replay-module, one will see the filename, the progress and the original TOD start and end time. (The fact that the modules referring to the MRD3 are yellow, means that no MRD3 is currently running.)

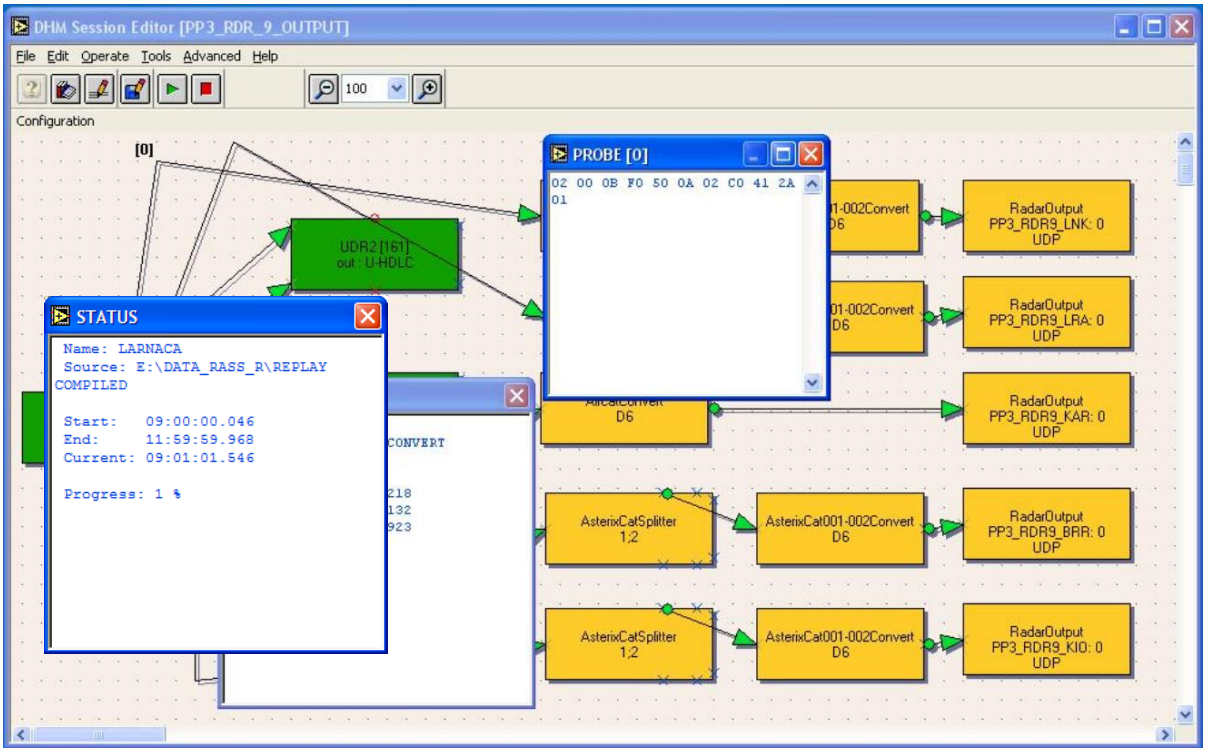


Figure 4-13: DHM Session active

Remark about ASTERIX CAT001 and ASTERIX CAT048:

Both ASTERIX versions use a different encoding of TOD:

- **ASTERIX CAT001/I141 Truncated Time of Day**: 16 bit value, which is the TOD reference to midnight and reset to zero every midnight
- **ASTERIX CAT048/I140 TOD**: 24 bit value, which is the absolute timestamp in UTC

Because of this difference, ASTERIX CAT001 will only show an updated TOD when the Time Of Recording (TOR) is set again. This is only done at DHM Input modules like: UDPInput, UDRInput etc.

For this reason, as in the DHM session PP3_RDR_9_OUTPUT, the replayed data in the MRD3 will still have the TOD from the recorded file, since the reference timestamp (TOR) is not updated yet.
On the contrary, ASTERIX CAT048, directly displayed in the MRD3, will show the actual TOD.

For correct creation of TOD and further time analysis, it is important to have the RASS-R UTC synchronized. (For example by NTP)

Remark about data sources without timestamp: (for example some versions of AIRCAT500)

If data sources without timestamp are replayed, it is clear that no timestamp will be updated nor added. Though, the Replay module allows replaying non-timestamped data (e.g. AIRCAT) for synchronization reasons with other timestamped data (ASTERIX).